Science, Industrial Technology and Economic Development: Empirical Study of China 1992-2002

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Outline

- Introduction
- Literature review: Science, technology and economic development
- The interaction between science and technology
- Empirical study
- Conclusion and policy implication

Introduction (1)

- Classical models
  - linear model
  - inverted linear model
- In the era of knowledge-based economy, more interactive process between science and technology are taking place in the developed countries(OECD,2002).
- However, the interaction of science, technology and economic development is integration of all factors harmoniously, hence it is always the sticking point of development. The interaction never happened automatically, especially in developing countries.

Introduction (2)

- The background of China
  - The fast development of China
  - The transformation of the nation's science and technology (S&T) system
  - The Chinese government as well as the citizens seems to recognize that the nation's prospects for sustainable growth in a global economy will depend on the further development of the S&T system and its continued integration with economy.

introduction (3)

- The problems with S&T in China
  - while large amounts of research output is registered in key science and technology programs, few of them are put into practical use.
  - SCI :the 6th in the world(2002)
  - EI :only 2nd to America(2002).
  - The overall output of science and technology is catching up, while the (endogenous)technological capability is still lag behind.

Objective of this paper

- How much contribution is made by science , technology in the progress of economic development?
- How much interaction exist between basic scientific research and industrial technology and how much does their mutual effect contribute to economy development?
- How can we integrate into this globalized knowledge-based (learning) economy with endogenous capability?

Literature review: Science, technology and economy

- *The present state of the nations is the result of the accumulation of all discoveries, inventions, improvements, perfections and exertions of all generations which have lived before us: they form the intellectual capital of the present human race, and every separate nation is productive only in the proportion in which it has known how to appropriate those attainments of former generations and to increase them by its own acquirements.*
- *There scarcely exists a manufacturing business which has not relation to physics, mechanics, chemistry, mathematics or to the art of design, etc. No progress, no new discoveries and inventions can be made in these sciences by which a hundred industries and processes could not be improved or altered. In the manufacturing State, therefore, sciences and arts must necessarily become popular*

—Lists(1841)

Literature review:

- Neoclassical growth theory
  - Two basic factors: technology and conventional inputs(such as capital and labor).
- New growth economics
- Innovation, especially NIS

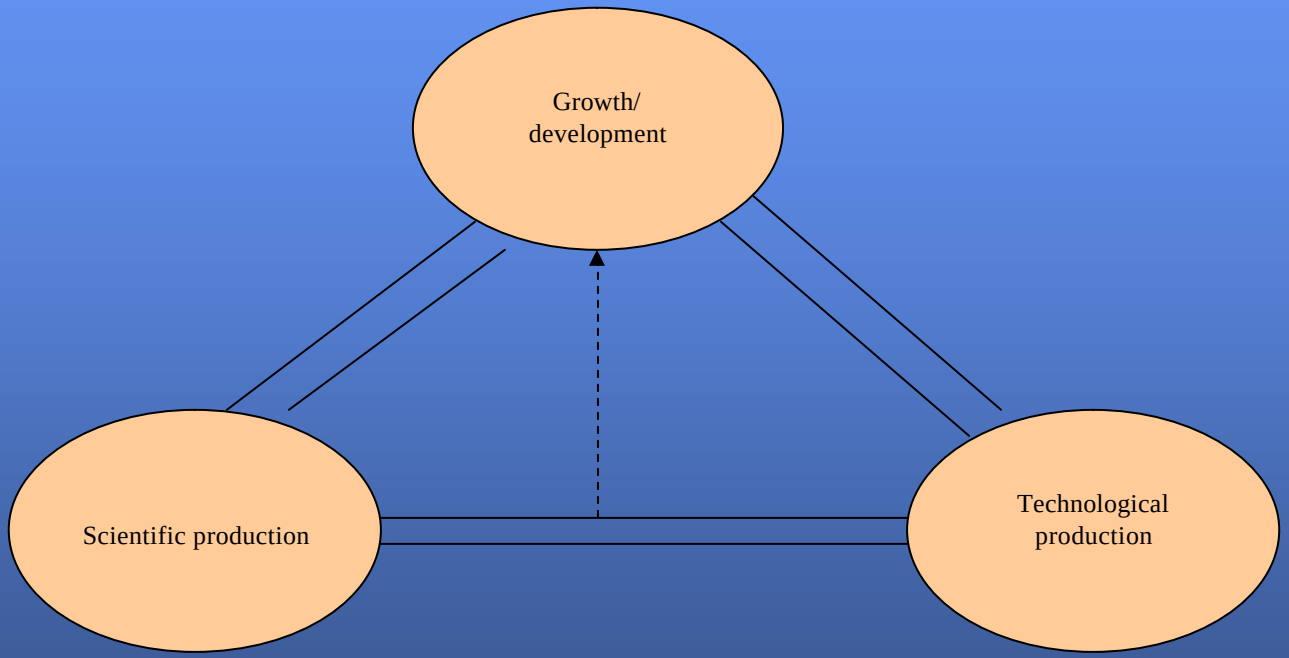
The interaction between science and technology

- The role of basic science.
- Absorptive capability for developing countries.
- The relationship between science and technology

Empirical study of China (1)

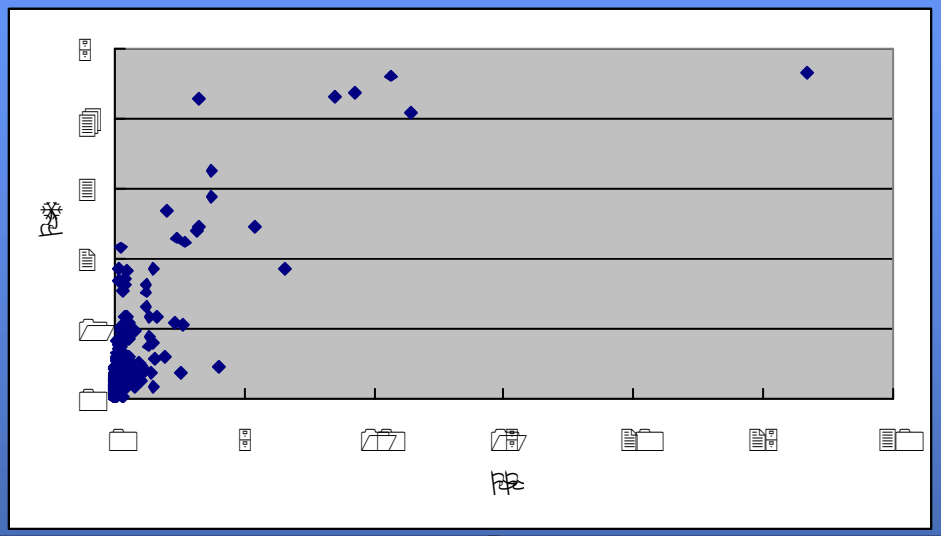
- **Indicators and data collection**
  - Scientific papers, Patents and GDP per capital
    - Patens:Granted patents in China
    - Scientific paper: indexed by SCI, EI, and ISTP
  - 30 provinces of China from 1992 to 2002

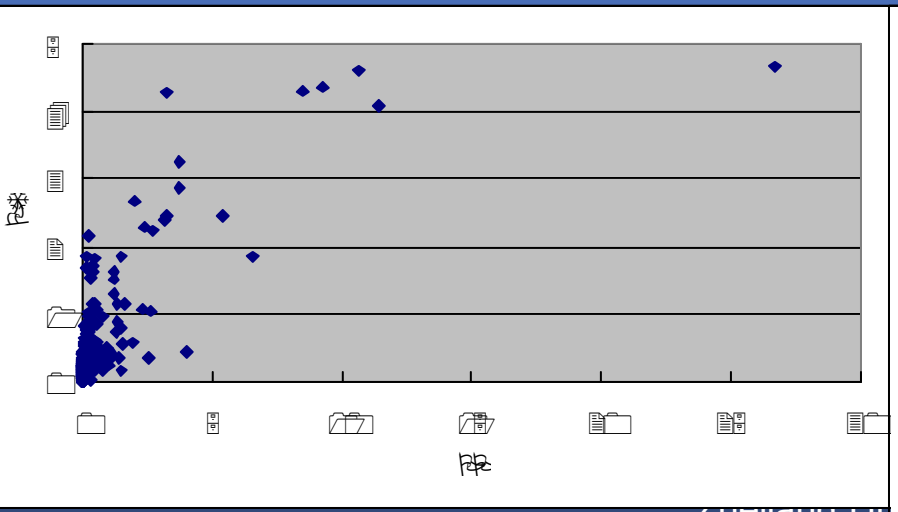
Empirical study of China (2)-Model

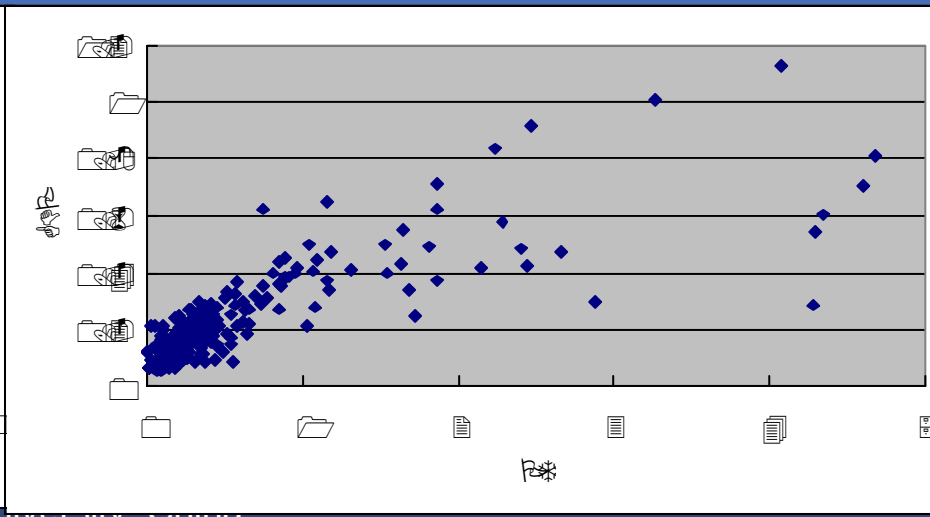


Modified from Bernardes&Albuquerque's paper

Empirical study of China (3)-Descriptive results







Empirical study of China (3) -fixed effects without interaction

- GDPit= e↑it+↓1PPit+↓2PTit+↗it (1) i=1,2…30
  T=1,2,…8

Dependent	Independent GDP			
	Coefficient	Std. Error	t-Statistic	Prob.
PP	0.016352	0.006262	2.611031	0.0095
PT	0.134681	0.019732	6.825603	0.0000
R-squared	0.888487	Mean dependent var	0.234298	
Adjusted R-squared	0.871867	S.D. dependent var	0.164200	
S.E. of regression	0.058777	Sum squared resid	0.718575	
F-statistic	1657.250	Durbin-Watson stat	1.642963	
Prob(F-statistic)	0.000000			

Empirical study of China (3)
-fixed effects with interaction

- GDPit= e↑it+↓1PPit+↓2PTit+↓3 PPit *PTit+↗it (2)

i=1,2…30
t=1,2,…8

Dependent	Independent GDP			
	Coefficient	Std. Error	t-Statistic	Prob.
PP	0.069491	0.011837	5.870763	0.0000
PT	0.135956	0.017232	7.889929	0.0000
PP×PT	-0.012114	0.002327	-5.205433	0.0000
Fixed effect				
R-squared	0.912233	Mean dependent var	0.234298	
Adjusted R-squared	0.898665	S.D. dependent var	0.164200	
S.E. of regression	0.052270	Sum squared resid	0.565559	
F-statistic	1075.756	Durbin-Watson stat	2.092203	
Prob(F-statistic)	0.000000			

Discussions (1)

- Government
  - Chinese government has been highly proactive in putting in place an institutional and organizational infrastructure that can ensure that S&T activities support the process of industrial development. The organizational structure of the S&T system includes National Key Laboratories for the basic research programs, National Engineering Centers for the high-tech research program, as well as Corporate R&D Centers and High- and New-Tech Developmental Zones for the technology.

Discussions (2)

- From the aspect of industry development
  - the technology imports of Chinese enterprises is hardly more than production line equipment, their profits come mainly from assembling and manufacturing.
  - The lessens we learn from Korea and Taiwan .
  - Nowadays globalization provides much more opportunity to catch-up countries to learn from the western world, however, without endogenous capability it is likely to slump into the vicious cycle of ‘import- lag behind- import’.

Discussions (3)

- Basic research aspect.
  - As a scientific producer, the appraisement and incentive system in universities is paper and projects oriented and based on short-term results
  - The most important support is still from governmental project.
  - It seems that there is a missing link between basic research and industry technology development.

Implications

- The interplay between science and technology must be taken into account for the study of China's economy development and the interaction mechanism must be investigated deeper to improve the economic efficiency.
- Science and technology institution building should be taken out further and the formation of well functioned NIS is a general prediction for development.

Reflection and Limitations

- The indicators.

As the intellectual property rights protection mechanism and consciousness is not well formed yet and the papers published focus much on repetition and imitation of developed countries, we meet problems not only in the development of S&T but also in measuring them.

- The measurement.

In this investigation, science, technology and economy is represented by a single indicator, it is in the risk of over-simplification and bias. It is a better way to choose a range of indicators and form a measuring system.

- Much work is needed!

Although it uncovered the defect of the interaction between S&T, it left to further study how to correct this deficiency. Hard work is need on the formation and perfection of national and regional innovation systems of China.

Thank you very much!

Wish you a nice weekend!